Commercial Production

Great Canadian Oil Sands Limited was incorporated in Canada in 1953. After obtaining successful extraction results from pilot-plant projects, the company applied for and received a permit from the Alberta government on April 10, 1964, for a 35,000-barrel-a-day separation plant. After overcoming many initial problems in the mining operation, production from this plant has gradually been increased to over 50,000 barrels a day.

GCOS uses bucket-wheel excavators that are capable of moving 6,000 tons of material an hour. At the outset, the project was the largest mining operation in Canada, moving 35 million tons of oil sands and 15 million tons of overburden annually. Over one quarter of a million tons of material, including 120 thousand tons of oil sands, are moved every day.

A second company, Syncrude Canada Limited, has been authorized to start construction of a $1-billion, 125,000-barrel-a-day facility at Mildred Lake, 25 miles north of Fort McMurray. The plant is scheduled for operation in 1978. The separation process will be similar to that used by GCOS.

Shell Canada Limited has filed an application with the Alberta Energy Resources Conservation Board for a 100,000-barrel-a-day plant to start operating by 1980. Petrofina Canada Limited and Home Oil Limited have also announced intentions to construct large plants with operation to start in the period 1982 to 1985. Other companies have also indicated interest in the oil sands operation.

Research on Athabasca Oil Sands

Federal. The Department of Energy, Mines and Resources, through its Mines Branch, has maintained an uninterrupted interest in the Athabasca oil sands for more than 60 years. From 1913 until his retirement in 1945 Mines Branch engineer S. C. Ells was in charge of all the branch's field work in the Athabasca region.

Over the years Mr. Ells mapped the entire oil sands area, demonstrated the usefulness of the oil sands as paving material, pioneered the exploration and sampling of the deposit, and studied methods to separate the bitumen from the sands.

In 1949 the Mines Branch built a large pilot plant in Ottawa using a "cold water" separation process but after the Alberta government showed a preference for the alternate "hot water" process the Mines Branch concentrated on the refining process for the bitumen. Branch scientists were the first to put the bitumen through all the processes to produce synthetic crude oil.

Since 1971 Branch scientists have been working on a refining process that eliminates the production of waste coke, reduces the sulphur content and increases the liquid fuel yield by about 20 per cent.

In 1974 the federal government allocated $40 million for research in the oil sands for the near future.

Provincial. For over 25 years the Research Council of Alberta has been active in research on the Athabasca oil sands. This has included research on the physical properties of oil sands and crude bitumen, process and product development, and collection, classification and dissemination of oil sands information. The council maintains an oil sands index and information center. Geological research programs have included detailed studies of the oil-impregnated strata as well as the overlying and underlying rocks.

In the 1920's a council scientist, Dr. Karl Clark, developed the hot-water flotation method that is basically the same as that used in commercial operations today. Since 1948 the council has conducted research and pilot plant experiments into ways of extracting the crude bitumen from the oil sands deposits, including large-scale, hot water separation tests at Bitumount.

In 1974 the Alberta government created the "Alberta Oil Sands Technology and Research Authority" with a budget of $100 million over a five-year period. The authority will mainly attempt to achieve, as rapidly as possible, a breakthrough in technology and research in the recovery of the crude bitumen from the deep locations by in situ methods.

Industry. Many companies have shown considerable interest in the oil sands and extensive research has been carried out on all aspects of the mining, primary extraction and refinery processes. In situ studies have been carried out and various procedures have been evaluated to determine the best methods to recover the bitumen.

Companies have tried to improve on the hot water flotation process that had been developed by Dr. Clark and put into practice by GCOS. Improvements in the refining of the bitumen have also been made to develop a better product.

Private industry will be encouraged to expand its research programs in cooperative programs with the Alberta Oil Sands Technology and Research Authority.

Cold Lake Heavy Oil Deposit

History

The heavy oil deposit in the Cold Lake area was discovered during exploration for conventional crude oil in Alberta, but to date this deposit has not been put into economic production. Extensive research has been carried out, however.

Problems of Recovery

The heavy oil deposit is generally about 1,000 to 2,000 feet below ground level; the oil cannot be recovered by normal means as it is too viscous to flow readily to the producing wells. However, there is a potential for large production from these deposits, estimated to contain 160 billion barrels of oil in place. Once the technology has been fully developed a possible 30 billion barrels might be recoverable, almost three times as much as the present proven Canadian conventional oil reserves.

The heavy oil deposit will be expensive to work. Higher crude prices and assured markets are needed to make extraction operations feasible. However, there has been considerable interest in this resource and by 1972, in the Cold Lake area alone, ten companies were engaged in preliminary research to develop the required technology.

Recovery Research

All the companies have tried to develop a system to reduce the viscosity of the oil and pump it to the surface. Different methods have been tried or considered including steam injection, controlled underground combustion and the injection of solvents such as diesel fuel. Some consideration has been given to the possibility of an underground nuclear explosion to improve oil recovery but the feasibility of this method is still under study.

The best current system for production from the heavy oil deposit seems to be the use of steam injection. This process has been nicknamed "huff and puff". Steam is pumped into the oil zone for about a month. This heats the oil and allows it to flow. The extra pressure created by the steam forces the oil to the recovery wells where it is pumped to the surface. Pumping continues for about three months, or until the oil can no longer be brought to the surface. The cycle is then repeated.

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Alberta Oil Sands

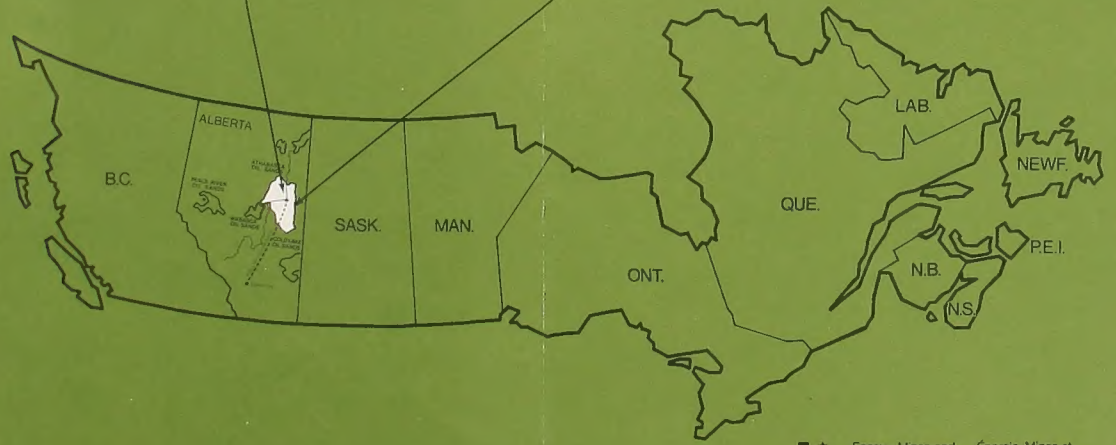
Alberta Oil Sands

What they are

The Alberta oil sands, or tar sands as they are also known, are located in the north and northeast of Alberta. The deposits, which are mainly in the Athabasca, Peace River, Wabasca and Cold Lake areas, consist of a mixture of sand, clay, water and a viscous crude bitumen. In the Cold Lake area the composition of the deposit is between an oil sand and a heavy crude oil.

How big they are

The oil sands deposits cover a total area of over 19,000 square miles; the Athabasca deposit, which is the largest, accounts for 9,000 square miles. It has been estimated that there are over 600 billion barrels of crude bitumen in place in the Athabasca area, 50 and 54 billion respectively in the Peace River and Wabasca deposits, and 164 billion in the Cold Lake deposit. The total of about 900 billion barrels may ultimately yield about 250 billion barrels of synthetic crude oil.



Energy, Mines and Resources Canada / Énergie, Mines et Ressources Canada

Athabasca Oil Sands

History

The first white man to see the Athabasca oil sands was explorer Peter Pond when he was looking for a site for a Hudson's Bay trading post in 1788. He established the post, later called Fort McMurray, at the junction of the Athabasca and Clearwater Rivers. Mr. Pond noticed the tar seeps on the bank of the Athabasca River and also that the Cree Indians mixed the oily substance found in the sand with spruce gum to waterproof their canoes. However, the oil sands did not become widely known until more than 100 years later.

The Geological Survey of Canada reported on the oil sands in 1884 and 1890, (R. G. McConnell); this was followed by the digging of the first exploratory well seven years later. It was unsuccessful in producing the oil as were all the other wells that were drilled in later years. Many persons, including a German aristocrat, Count Alfred Von Hammerstein, believed there were pools of oil beneath the oil sands

but this theory proved to be wrong. Other ways to recover the oil were tried but success did not come to these early entrepreneurs.

The International Bitumen Company was the first commercial company to recover any of the oil. This company started to operate in 1930, the same year that a scientist of the Research Council of Alberta, Dr. Karl Clark, set up a pilot plant using hot water to separate the oil from the sand.

In 1936 another company, Abasand Oils Limited, started production in the area with one 250-ton-a-day extraction plant. The following year an additional 400-ton-a-day plant was built but both burned down in 1941. The federal government took over the company in 1943 and built a 100-ton-a-day separation plant. A 500-ton-a-day plant was added in 1945 but later that same year these plants, too, burned down.

Interest in the oil sands waned with the discovery of the large conventional oil fields in Alberta in the late 1940's and early 1950's, but the Research Council of Alberta restarted pilot-plant operations near Fort McMurray in 1948. Intensive research was carried out by the council scientists, and also by the federal government's Mines Branch, but separation by hot-water flotation still appeared to be the best way to recover the oil.

In 1967 Great Canadian Oil Sands Limited (GCOS) began extracting the bitumen from the sand 23 miles from Fort McMurray with the first large-scale commercial mining and extraction plant based on open-pit mining and the Clark extraction process.

Present Methods of Recovery

The oil sands vary in depth of overburden from ground level to about 2,000 feet. Down to about 200 feet, the sands can be mined by open-pit mining but beyond that depth this mining technique may be too expensive. Other ways to recover the bitumen by in situ processes are under intensive study by both industry and government.

In open-pit mining the first task is the removal of the muskeg and the overburden, that part of the ground overlying the actual oil sands. This earth may be used to construct large dikes, some of which are 300 feet high, to contain the water effluent from the extraction process. Alternatively, it may be returned to the mine pits after removal of the oil sands.

Large bucket-wheel excavators about 100 feet high, or huge drag lines, are used to remove the oil sand mixture. The abrasive sand is hard on the equipment, which has to operate in temperatures that range from 90°F (32°C) to 60°F below zero (−50°C). Once the sand containing the oil has been removed, it is dropped onto conveyor belts and taken to a nearby separation plant. Here, the oil sand is treated with hot water to effect the separation of the sand from the heavy, bituminous oil. This oil is then processed in oil refining type equipment to produce a synthetic crude oil of higher quality than most natural crude oils. The coke residue is burned in the power plant, which produces electricity, steam and hot water for the project.

Environmental Considerations

High environmental standards have been set for the oil sands mining and processing operations. Disturbed land will be landscaped, top soil replaced and new vegetation planted. Equipment will be installed to prevent air pollution by sulphur compounds and to treat all water prior to returning it to the Athabasca River.